W. CRAIG.

Direct Acting Steam-Pump.

No. 208,797. Patented Oct. 8, 1878.

Fig. 1.

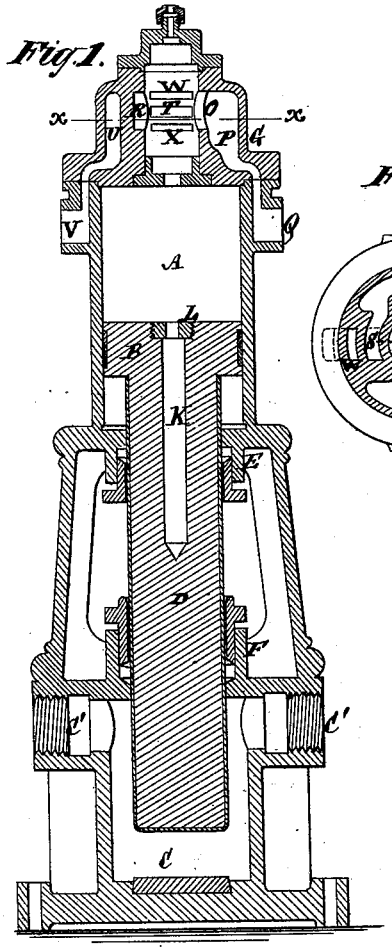


Fig. 3.

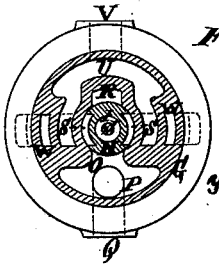


Fig. 4.

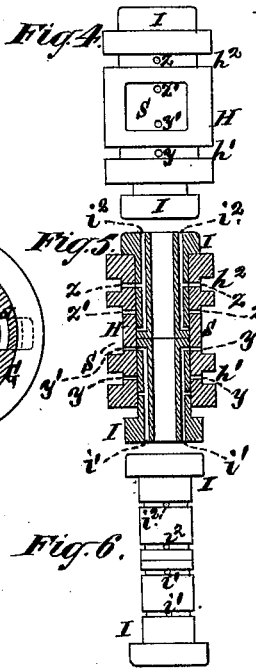


Fig. 2.

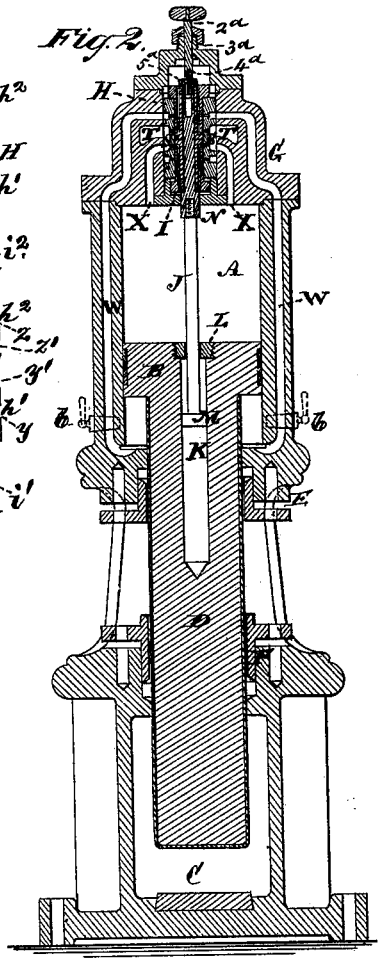
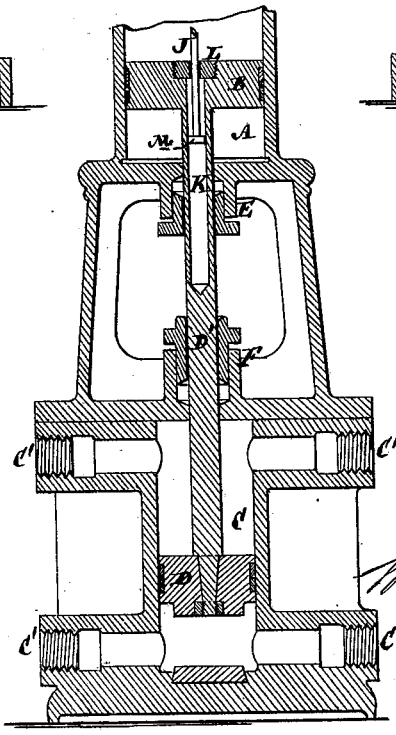


Fig. 7.



Witnesses

John Becker

Fred. Haynes

Inventor

William Craig

by his Attorneys

Brown & Allen

UNITED STATES PATENT OFFICE.

WILLIAM CRAIG, OF NEW YORK, N. Y.

IMPROVEMENT IN DIRECT-ACTING STEAM-PUMPS.

Specification forming part of Letters Patent No. **208,797**, dated October 8, 1878; application filed July 17, 1878.

To all whom it may concern:

Be it known that I, WILLIAM CRAIG, of the city and State of New York, have invented certain Improvements in Direct-Acting Steam-Pumps, of which the following is a description, reference being had to the accompanying drawing, forming part of this specification.

This invention relates to that class of steam-pumps in which the main steam slide-valve of the pump is actuated by the steam without the intervention of eccentrics, cranks, or cams, an auxiliary slide-valve, actuated by the main steam-piston or piston-rod of the pump, being used to govern the action of the steam upon the main slide-valve.

Although the invention will here be shown as applied to a vertical steam-pump, it is equally applicable to pumps arranged to work horizontally, obliquely, or otherwise, and whether the pump be a single-acting plunger one or a double-acting piston one; but the invention is more especially intended to be used in connection with a vertical direct-acting steam-plunger or piston-pump having neither cranks, eccentrics, nor cams, and adapted for feeding boilers and other purposes, and which, besides being simple and cheap in construction, shall act with greater certainty or more perfectly than other vertical direct-acting steam-pumps having steam-moved valves.

In carrying out my invention I employ an ordinary arrangement of a steam-cylinder and a pump-barrel in line with each other, and either formed of a single casting or in different parts, properly secured together; also arrange, as in certain other direct-acting engines, the valve-chest on the end or cover of the steam-cylinder opposite to that at which the pump-barrel is placed, such valve-chest, with its contained valves, being by preference placed concentrically and in line with the axis of the steam-cylinder; but they may be placed eccentrically with regard to said axis.

The steam-valves are of the sliding cylindrical kind, consisting of a main valve for governing the inlet and outlet of the steam to and from the steam-cylinder, and of an auxiliary valve, preferably arranged to work within the main valve, for governing the inlet and outlet of steam to and from the faces or ends of the said main valve; and I sometimes employ, in connection with the aforesaid main steam-valve, a double set of ports and passages formed in the opposite sides of the valve-chest and communicating with the two ends of the steam-cylinder, whereby the said valve is more perfectly balanced, and for a given amount of travel it effects a greater opening of port or area of steam-passage than is usually obtained with this class of steam-valves; but such arrangement of double ports and passages forms no special feature of this invention.

In order to operate the auxiliary valve at the proper times to govern the admission of steam to and from the faces or ends of the main steam-valve when the main steam-piston approaches the end of its stroke, I employ a rod connected to the said auxiliary valve, and arranged to extend into a hole or recess formed in the piston and piston-rod or pump-plunger, such rod being acted upon by suitable parts or devices connected to the piston coming in contact with stops on the said rod as the piston approaches the end of its stroke in either direction.

The ports and passages in the main steam and auxiliary valves are so arranged in relation to each other and to the ports and passages in the valve-chest, and the surfaces of the auxiliary valve are so adapted to those of the main steam-valve, that the reduced pressure consequent upon the exhaustion of the steam from one side or end of the main and auxiliary valves assists the steam-pressure acting on the other side or end of the main and auxiliary valves, tending to hold them both firmly and with certainty in their proper positions while the main steam-piston is making its stroke, and until the auxiliary valve is moved thereby preparatory to a fresh stroke of the main steam-valve. This effect is more prominent when a condenser is employed in connection with the steam-cylinder.

Figure 1 in the drawing represents a vertical section of a direct-acting steam-plunger or single-acting pump constructed in accordance with my invention, but having the steam-valves removed in order to show more clearly the steam and exhaust ports in the valve-chamber. Fig. 2 is a vertical section at right angles to Fig. 1, with the valves in position. Fig. 3 is a horizontal section through the valves and valve-chest on the line *x x*. Figs.

4, 5, and 6 represent longitudinal exterior views and a longitudinal section, respectively, and upon a larger scale, of the valves removed from the valve-chest. Fig. 7 is a vertical section of a double-acting-piston steam-pump, in part, with so much of the invention applied thereto as is necessary to explain its adaptation to such a pump.

Referring more particularly to the first six figures of the drawing, A is the steam-cylinder of the pump, and B its piston. C is the pump-barrel, and D its plunger. Said plunger D passes through stuffing-boxes E and F, as usual.

G is the valve-chest, bolted or otherwise secured onto the end of the steam-cylinder. H is the cylindrical main valve, for controlling the admission and exhaustion of the steam to and from the steam-cylinder A, such main valve H being actuated, as hereinafter explained, by steam admitted to the ends thereof by the auxiliary valve I, which latter is operated at the proper time by the rod J attached thereto. Said rod J extends into a hole or recess, K, formed in the piston B and plunger D, Figs. 1 and 2, and is acted upon by the tappet or catch-piece L, screwed or otherwise secured within one end of the hole or recess K, as said tappet L comes in contact with a stop or enlargement, M, of the rod J, as the piston B approaches the end of its downward stroke, and against a stop or enlargement, N, as it approaches the end of its upward stroke.

The main cylindrical steam-valve H, which slides up and down within the valve or steam chest G, has formed in it two annular grooves, h^1 h^2, which communicate by an opening, O, at all times with the chamber P, into which steam enters from the boiler through the passage Q. The grooves h^1 h^2 also communicate with a chamber, R, opposite to the chamber P, conducting steam from the latter thereto, by which means the pressure of steam in the chamber P, acting against the surface of the main valve H, exposed at the opening O, is balanced.

S S are opposite exhaust-cavities in the main valve H, corresponding to duplicate exhaust-ports T T in the valve-chest, such exhaust ports or passages uniting into one passage, U, leading to the exhaust-outlet V.

W W are steam ports and passages leading to the lower end of the steam-cylinder, and X X are steam ports and passages leading to the upper end of the steam-cylinder.

The auxiliary valve I is adapted to slide up and down in a cylindrical hole formed through the main steam-valve, and, as shown in Figs. 2, 5, and 6, may be divided transversely through its center or formed in halves for the convenience of introducing it within the main valve, such halves being united by the rod J passing through them and secured by a nut at the top, as shown. Said auxiliary valve I has formed at its ends heads or collars, which limit its longitudinal movement in the main valve.

Instead of forming the auxiliary valve in halves, it may be made mainly of one piece by leaving one of the heads or collars loose, and securing it to the body of said valve by screwing or otherwise after the auxiliary valve has been passed into the main valve.

In the auxiliary valve I contracted passages i^1 i^1 and i^2 i^2 are formed and arranged to correspond alternately, accordingly as the auxiliary valve is moved in one direction or the other within the main valve, with small ports y y and z z formed in the latter, for the purposes hereinafter explained.

The suction and delivery valve boxes of the pump are connected to the nozzles c' in any manner that may be convenient and suitable.

The action of the parts is as follows: When the piston B arrives at or near the end of its upstroke, the tappet L comes in contact with the stop N, and raises the rod J, and with it the auxiliary valve I, until the ports and passages i^1 i^1 communicate by branch or lateral apertures with the ports or passages y y in the main valve H. Steam then passes from the groove h^1 through the passages i^1 i^1 into the space below the auxiliary valve I, and acting on the under side of the auxiliary and main valves raises them both until the groove h^1 comes opposite the steam-ports X X, thus admitting steam to the top side of the piston B. The same upward movement of the main valve brings the exhaust-cavities S S over the steam-ports W W, thus opening communication between the exhaust-outlet and the under side of the piston B. When the piston B arrives at or near the end of its downstroke the tappet or catch-piece L comes in contact with the stop M and draws down the rod J, and with it the auxiliary valve I, until the ports or passages i^2 i^2 communicate by branch apertures with the ports or passages z z in the main valve. Steam then passes from the groove h^2 through the passages i^2 i^2 into the space above the auxiliary valve I, and acting on the upper side of the auxiliary and main valves presses them both downward until the groove h^2 comes opposite the steam-ports y y, thus admitting the steam to the under side of the piston B. The same downward movement of the main valve brings the exhaust-cavities S S over the steam-ports z z, thus opening communication between the exhaust-outlet and the upper side of the piston. In Fig. 2 the parts are shown in the positions last described, suitable for the ascent of the piston.

It will be understood that the movement of the auxiliary valve upward, which brings the ports or passages i^1 i^1 in communication with the ports or passages y y in the main valve, so as to admit steam from the groove h^1 to the space below the said auxiliary and main steam-valves, also brings the ports or passages i^2 i^2 opposite ports or passages y' y' in the main valve H, which open into the exhaust-cavities thereof, by which means the steam which has acted above the auxiliary and main valves to press them downward is allowed to escape, and that conversely the movement of the aux-

iliary valve downward, which brings the ports or passages i^2 i^2 opposite the ports or passages z z, in the main valve H, so as to admit steam from the groove h^2 to the space above the said auxiliary and main steam-valves; also brings the ports or passages i^1 i^1 opposite ports or passages z' z', in the main valve, which open into the exhaust-cavity thereof, by which means the steam which has acted below the auxiliary and main valves to press them upward is allowed to escape.

In the arrangement above described and illustrated in Figs. 1 and 2, a set of steam and exhaust ports and passages are used on opposite sides of the main valve, whereby, as hereinbefore described, said valve is more equally balanced than when one set only is used, and a greater opening of port for a given amount of valve travel may be obtained than is usual with this class of steam-valves; but I do not confine myself to such arrangement, as in some cases I employ only one set of such ports and passages, and then only one set of small ports, i^1 i^2, is required in the auxiliary valve; or, again, when it is not required that the main valve should be a balanced one, yet should operate in concert with a set of steam and exhaust ports or passages on opposite sides of it, the same may be divided longitudinally into halves, and said halves be connected by dowel-pins to move together longitudinally.

The passages W W may be provided with adjustable or regulating valves b b, to adapt the pump to different working conditions, as against or with pressure.

Cushioning the steam at the end of the stroke of the steam-piston may be effected by causing the steam-passages to enter the cylinder at a short distance from the ends in the usual manner.

To enable the auxiliary valve I to be moved by hand when necessary, a rod, 2^a, passes through a stuffing-box, 3^a, at the top of the valve-chest, and carries at its lower end a pin, 4^a, the head of which enters a recess in the rod J, a nut, 5^a, which screws onto the rod J, encircling the pin 4^a. The head of the pin may be made to act upon the rod J, and consequently the auxiliary valve attached thereto, by drawing out or pushing in the rod 2^a, the play of the head of the pin 4^a in the recess of the rod J allowing of the motion of the latter with the auxiliary valve when the pump is at work without giving motion to the rod 2^a.

In the drawing the auxiliary and main valves and valve-chest are shown concentric with the steam-cylinder, and such arrangement is in most cases preferable, on account of simplicity and facility of manufacture; but they may be arranged eccentrically with regard to the axis of the steam-cylinder without departing from my invention.

Fig. 7 of the drawing shows the rod J of the auxiliary valve, which is operated by the main steam-piston B, as applied to a double-acting pump, a rod, D′, from the pumping-piston D connecting with the steam-piston and the recess K, within which the rod J enters, being arranged to pass through the steam-piston and into said rod, which, with its attached pumping-piston, corresponds to the plunger of the single-acting pump. So far as the construction, arrangement, and operation of the main and auxiliary valves, however, is concerned, there is no difference between the application of the invention to a single and a double acting pump, a tappet, L, connected with the piston, acting against stops on the rod J to start the auxiliary valve alternately in opposite directions, as in case of the single-acting pump.

I claim—

1. The combination, with the auxiliary valve, of its operating devices, controlled by the motion of the steam-piston, and arranged within the steam-cylinder and steam-chest of the pump, the same consisting of a rod, J, connected with the auxiliary valve, the piston and pump plunger or rod having a hole or recess, K, in them, the stops M and N on the rod J, and the tappet or catch-piece L secured to the piston, essentially as shown and described.

2. A direct-acting steam-pump provided with slide-valves arranged for operation in line with the steam-cylinder, and having its auxiliary valve operated by the movement of the steam-piston by means of devices contained within the steam-cylinder and valve-chest, the whole being combined and arranged for operation, essentially as specified.

WILLIAM CRAIG.

Witnesses:
ALFRED BURHORN,
T. J. KEANE.